Independent Pricing and Regulatory Tribunal
New South Wales

Estimating Equity Beta
for the Weighted Average Cost of Capital

Final Report
Research

August 2020

Disclaimer

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The Independent Pricing and Regulatory Tribunal (IPART)

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Tribunal Members

The Tribunal members for this review are:

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Contents

1 Overview

The Weighted Average Cost of Capital (WACC) is an important input for all our pricing reviews, in water, rail access and other industries where we set, recommend or arbitrate prices. We use it to determine the permitted return on assets. Many WACC inputs are sensitive to current observations of debt and equity markets, while other inputs are industry-specific and tend to vary more slowly.

Equity beta is one such industry-specific input. It reflects the level of systematic risk faced by a firm in a particular type of industry. That is the extent to which a firm's returns co-vary with returns to the market as a whole. Equity beta is a key input to our determination of the cost of equity using the Capital Asset Pricing Model (CAPM). There are well-established econometric methods for estimating the equity beta of a particular listed firm.[1]

The challenge is to determine a representative beta for the firm that we regulate, where it may not be listed on any stock exchange. To do this, we identify listed proxy firms that operate in the same industry or activity as the regulated firm, assuming that they have a similar systematic risk profile to the regulated firm, and then estimate equity beta for those firms.

This type of proxy company analysis is well established in financial economics and regulatory practice. The challenges in doing it well are twofold. First, some judgement is required in selecting suitable proxy firms. Second, it is necessary to ensure that the estimated equity beta values are statistically sound.

1.1 Final decisions

We have made five final decisions after conducting our own analysis and considering the matters raised in submissions on our draft report. These decisions are unchanged from our draft report, as they were supported by all submissions.

1. Use weekly returns rather than monthly returns and examine all five possible reference days (ie, weekly average Monday to Friday, Tuesday to Monday, Wednesday to Tuesday, Thursday to Wednesday, and Friday to Thursday) to estimate beta
2. Change the threshold for inclusion of a proxy firm to 60 months minimum available return data for each reference day rather than 36 months
3. Use the market value of equity to calculate gearing and use average gearing over the sample period to de-lever observed equity betas rather than gearing measured at the end of the estimation period
4. Use the Brealey-Myers de-levering formula, which omits the tax term, rather than the Hamada formula

1 The significance of listing is that stock markets provide daily information on stock prices and dividends for listed firms, which permit direct measurement of returns (ie, profits to shareholders).

5 Adopt the decision rule that before considering any revision to an established beta value for a price review:

– Prior beta estimate is more than one standard deviation from the mean of the current sample, and

– Persistent evidence over long period (ie, a regulatory period of four years or longer) of changed beta.

These decisions, in particular decision 5, reflect our position going into the 2020-2021 review of the WACC method. We recognise the possibility that stakeholder consultation in that review may result in changes to the equity beta method.

For the avoidance of doubt, under decision 5 the persistent evidence period of four years or longer would begin no earlier than August 2020.

We consider that these five final decisions provide for a more stable and statistically reliable method to estimate equity beta. These decisions assist with maintaining the stability, certainty, replicability and predictability of our WACC method, as well as ensuring it produces reasonably accurate estimates. Submissions emphasised the importance of stability of outcomes and otherwise were supportive of these decisions.

We have confirmed the feasibility of modifying our beta estimation tools to implement these decisions. We would implement these changes for reviews that have not yet reached the Issues Paper stage before the end of August 2020.

1.2 We reviewed our WACC method in 2017-18

In our review of the WACC method during 2017-18 we undertook extensive consultation. Our final decisions on equity beta from our 2017-18 review are shown in Box 1.1.[2] During that review, stakeholders requested more specific detail on how we proposed to select proxy firms and estimate their equity betas.

Our recent consultation on the equity beta method arose from that stakeholder request. We published an issues paper in April 2019 and a draft report in March 2020 on the equity beta method. This report explains our final decisions to modify our equity beta method including our response to stakeholder submissions.

2 Final Decisions 25-28, pp 61-65.

Box 1.1 Final Decisions on Equity Beta from our 2018 Final Report on WACC

We made four final decisions on the calculation of equity beta:

25. Continue to re-estimate equity betas at each price review to inform our assessment of whether the existing estimates remain appropriate.
26. Use the broadest possible selection of proxy companies to estimate equity beta, but exclude thinly traded stocks.
27. Adopt a proxy selection process that includes:
    a) publishing our criteria for proxy selection, and our list of comparator companies that meet our criteria at the start of the relevant review, and
    b) giving stakeholders the opportunity to propose additional comparable industries that meet our criteria.
28. Determine the appropriate equity beta having regard to equity betas calculated using the Ordinary Least Squares (OLS) method with the Vasicek adjustment.

Source: IPART, *Review of our WACC method, Final Report*, February 2018, pp 61-65

1.3 Interactions between equity beta method and our 2020-21 WACC review

We intend to undertake a further review of our WACC method. We will release a short position paper in September 2020 which outlines our proposed focus areas, review process and timetable for comment. One of the motivations of this further WACC review is the level of stakeholder interest in the interaction between inflation and WACC in our three 2020 water price reviews (Sydney Water, Hunter Water and WaterNSW Greater Sydney).

It is possible that we will decide to make further changes to our equity beta method as a result of consultation in the 2020-21 WACC review. However, pending any such changes, the equity beta method outlined in this report will be applied for all pricing reviews that have not yet reached the Issues Paper stage by the end of August 2020.

That is not to say that there would be any change to an established beta in the near term. Our final decision 5 invokes a decision rule that before considering any revision to an established beta value for a price review, we would require persistent evidence over long period (ie, a regulatory period of four years or longer) of changed beta. Under this rule, the earliest opportunity to change an established beta value would be four years from now.

2 Matters raised in submissions

We received four submissions on our draft report on the equity beta method:

- Sydney Desalination Plant (SDP)[3]
- Sydney Water[4]
- WaterNSW[5]
- Public Interest Advocacy Centre (PIAC)[6]

The four submissions supported our general approach to equity beta. Recommendations in the submissions were mainly on matters of detail.

A critical part of our equity beta method is the selection of proxy companies. The selection rules on which we consulted are summarised in Table 2.1 below.

3 Sydney Desalination Plant, Submission to IPART Draft Report – Estimating Equity Beta, May 2020 (SDP submission), https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-submissions-sea-wacc-methodology-2017-estimate-equity-beta/draft-report-estimating-equity-beta/online-submission-sydney-desalination-plant-pty-limited-j.-de-lorenzo-11-may-2020-131241167.pdf

4 Sydney Water, Submission to IPART Draft Report – Estimating Equity Beta, May 2020 (Sydney Water submission), https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-submissions-sea-wacc-methodology-2017-estimate-equity-beta/draft-report-estimating-equity-beta/online-submission-sydney-water-z.-peroski-22-may-2020-154941770.pdf

5 WaterNSW, Submission to IPART Draft Report – Estimating Equity Beta, May 2020 (WaterNSW submission), https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-submissions-sea-wacc-methodology-2017-estimate-equity-beta/draft-report-estimating-equity-beta/online-submission-waternsw-m.-martinson-22-may-2020-095400000.pdf

6 PIAC, Submission to IPART Draft Report – Estimating Equity Beta, May 2020 (PIAC submission), https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-submissions-sea-wacc-methodology-2017-estimate-equity-beta/draft-report-estimating-equity-beta/online-submission-piac-m.-ediriweera-1-may-2020-073629666.pdf

Table 2.1 Sample selection rule summary

Criteria
Pre-estimation screening rules
Industry
What industry, or industries, should be used to identify proxy firms?
Firm Characteristics
Does the firm operate in the nominated industry?
Does the firm undertake its activities in capital markets that are sufficiently similar to Australia?
Does the firm have a similar operating profile to the benchmark efficient firm?
Market
Is the sovereign's government bond market sufficiently deep and liquid?
Is the sovereign's equity market sufficiently deep and liquid?
Operating Profile
Is the firm's revenue predominately in the nominated industry?
Liquidity filters & data quality
Remove a weekly observation for a given stock if there is less than 2 days of trading data available.
Remove a weekly observation for a given stock if the calculated Amihud measure exceeds the threshold of 25.
Remove the firm if it has less than 260 weeks of trading data available.
Post-estimation screening rules
Is the sample size sufficiently large?
Are the estimates consistent (no extreme outliers)?
Are there obvious biases in the results?
Are there any data consistency issues (eg. Is the stock's listing exchange consistent with its actual operating market?)

Source: IPART analysis

2.1 Sampling rules well accepted

The draft report proposed to increase the threshold for inclusion of a proxy firm from 36 months trading data to 60 months (260 weeks). This suggestion is based on improving statistical reliability. All submissions on the draft report supported it.

In an attachment to the WaterNSW submission, consultants CEG noted that we did not specify the length of the sample period over which we would be looking at firm data when calculating our benchmark beta. It is our intent to not have a set period over which we will perform analysis set in advance. The sample period will be assessed on a review by review basis, with stakeholders given an opportunity to comment on our proposed sample period as part of the review process.

The draft report also proposed that we sample returns weekly rather than monthly and that we consider every possible reference day used to calculate returns (ie, weekly average Monday to Friday, Tuesday to Monday, Wednesday to Tuesday, Thursday to Wednesday, and Friday to Thursday). This is because weekly beta estimates can be sensitive to the choice of reference day.[7] These suggestions are also based on improving the statistical reliability of beta estimates. The submissions on the draft report supported this.

We note that adopting this suggestion increases the amount of data we need to download and process. We have modified our beta estimation R scripts and our data interface with our main data provider, Thomson Reuters, to accommodate these changes. We have confirmed that our modified scripts can implement them correctly. We intend to make our new R scripts available to stakeholders to help them to replicate our results. We will provide the detailed instructions on our website.

2.2 Calculation of gearing for a proxy firm

In our draft report we proposed to calculate the gearing of a proxy firm based on the market value of equity and use the average gearing over the *sample period*. The four submissions supported this proposal.

On behalf of WaterNSW, its consultant CEG suggested that we should clarify whether we intend to calculate the debt component of the gearing ratio based on each company's book value of total debt or the book value of net debt.[8] It is our procedure to use the book value of total debt to calculate the debt component of a company's gearing ratio.

2.3 De-levering formula

In our draft report we proposed that, in de-levering equity betas for proxy firms, we would use the Brealey-Myers formula, which applies when the *gearing ratio* remains constant (ie, the amount of debt is increased as market capitalisation increases to maintain the gearing ratio). The four submissions supported this proposal.

2.4 Maintaining a status quo bias

Our draft report included a threshold test to be applied before changing a beta estimate that had been used in a prior price review for a particular industry. Noting that beta estimates are imprecise and volatile, and that small changes in beta can lead to large changes in prices, we are aware of the possibility that new analysis could result in departures from the status quo beta that are driven by noisy data rather than genuine market trends.

In order to guard against that possibility, our draft report proposed that the following points be considered in any decision to depart from a prevailing beta estimate:

- Changing an established equity beta would only be contemplated if the established value was more than one standard deviation from the new mean estimate.
- Stakeholder submissions and preference for stability would be taken into account.
- Departure from the status quo would only be contemplated if the evidence supporting a different value was persistent over a long timeframe (ie, a regulatory period or longer).

7 The risk of estimation error due to the choice of reference day is known in the empirical finance literature as reference day risk.

8 CEG, *Memorandum – Equity beta estimates using IPART's approach*, May 2020, p 8.

WaterNSW’s consultant CEG questioned whether this decision rule was in error and we had intended to say “*one standard deviation from the **median** of the current sample*.

For the avoidance of doubt, our point estimate of beta is the median. Nevertheless, the one standard deviation range in the decision rule is centred on the mean, because that range has a standard interpretation in probability terms.

No other stakeholders questioned or disagreed with the threshold or decision rule.

2.5 Programming code

In the interest of transparency and replicability, it is our intention to publish non-proprietary, de-identified versions of our updated R script and the accompanying Excel template file with this final report.

Stakeholders with the appropriate data licences will be able replicate our analysis using these scripts. It will also remove any doubt about our procedure as the code lays the process out exactly and unambiguously.